Claims:

1. A method for determining characteristics of a coating on a substrate that form an object, said method comprising:

providing an apparatus comprising:

means for supporting said object,

an indenter for interacting with said object,

a loading unit for applying a force between said object and said indenter,

means for providing a relative movement between said object and said indenter,

means for forming an electrical circuit comprising a source of electrical power, a first electrical contact, and a second electrical contact, and

means for measuring electrical characteristics of said electrical circuit;

selecting said object from a combination of a conductive coating with a non-conductive substrate and a non-conductive coating with a conductive substrate;

connecting said first contact to said conductive coating when said object comprises said combination of a conductive coating with a non-conductive substrate and to said conductive substrate when said object comprises said combination of a non-conductive coating with a conductive substrate;

connecting said second contact to a component selected from the group consisting of said conductive coating and said indenter, said conductive coating being selected if said object comprises said combination of a conductive coating with a non-conductive substrate, and said indenter being selected if said object comprises said combination of a non-conductive coating with a conductive substrate; at least a part of said indenter that interacts with said non-conductive coating being conductive if said indenter is selected;

causing said relative movement between said object and said indenter;

applying a predetermined force between said indenter and said coating by said loading unit;

measuring said electrical characteristics of said electrical circuit; and

determining said characteristics of said coating by analyzing said electrical characteristics of said electrical circuit.

2. The method of Claim 1, wherein said predetermined force is selected from a constant force and an increasing force.

3. The method of Claim 1, wherein said relative movement is selected from the group consisting of a linear unidirectional motion, linear reciprocating motion, rotary unidirectional motion, and rotary reciprocating motion.

4. The method of Claim 1, wherein said means for providing a relative movement provides two relative movements selected from the group consisting of a linear unidirectional movement, linear reciprocating movement, rotary unidirectional movement, and rotary reciprocating movement.

5. The method of Claim 2, wherein said relative movement is selected from the group consisting of a linear unidirectional motion, linear reciprocating motion, rotary unidirectional motion, and rotary reciprocating motion.

6. The method of Claim 2, wherein said means for providing a relative movement provides two relative movements selected from the group consisting of a linear unidirectional movement, linear reciprocating movement, rotary unidirectional movement, and rotary reciprocating movement.

7. The method of Claim 1, wherein said electrical characteristics measured by said means for measuring electrical characteristics of said electrical circuit are selected from the group consisting of electrical current, electrical voltage,

electrical resistance, electrical conductivity, electrical capacitance, and electrical impedance.

8. The method of Claim 2, wherein said electrical characteristics measured by said means for measuring electrical characteristics of said electrical circuit are selected from the group consisting of electrical current, electrical voltage, electrical resistance, electrical conductivity, electrical capacitance, and electrical impedance.

9. The method of Claim 3, wherein said electrical characteristics measured by said means for measuring electrical characteristics of said electrical circuit are selected from the group consisting of electrical current, electrical voltage, electrical resistance, electrical conductivity, electrical capacitance, and electrical impedance.

10. The method of Claim 4, wherein said electrical characteristics measured by said means for measuring electrical characteristics of said electrical circuit are selected from the group consisting of electrical current, electrical voltage, electrical resistance, electrical conductivity, electrical capacitance, and electrical impedance.

11. The method of Claim 1, wherein said step of determining said characteristics of said coating by analyzing said electrical characteristics of said electrical circuit comprises detecting a moment when said electrical characteristics change, wherein said change is an increase of said characteristics above a predetermined value for said object that comprises said combination of a conductive coating and a non-conductive substrate, and said change is a decrease of said characteristics below a predetermined value for said object that comprises said combination of a non-conductive coating and a conductive substrate.

12. The method of Claim 2, wherein said step of determining said characteristics of said coating by analyzing said electrical characteristics of said electrical circuit comprises detecting a moment when said electrical characteristics change, wherein said change is an increase of said characteristics above a predetermined value for said object that comprises said combination of a conductive coating and a non-conductive substrate, and said change is a decrease of said characteristics below a predetermined value for said object that comprises said combination of a non-conductive coating and a conductive substrate.

13. The method of Claim 3, wherein said step of determining said characteristics of said coating by analyzing said electrical characteristics of said electrical circuit comprises detecting a moment when said electrical characteristics change, wherein said change is an increase of said characteristics above a predetermined value for said object that comprises said combination of a conductive coating and a non-conductive substrate, and said change is a decrease of said characteristics below a predetermined value for said object that comprises said combination of a non-conductive coating and a conductive substrate.

14. The method of Claim 4, wherein said step of determining said characteristics of said coating by analyzing said electrical characteristics of said electrical circuit comprises detecting a moment when said electrical characteristics change, wherein said change is an increase of said characteristics above a predetermined value for said object that comprises said combination of a conductive coating and a non-conductive substrate, and said change is a decrease of said characteristics below a predetermined value for said object that comprises said combination of a non-conductive coating and a conductive substrate.

15. The method of Claim 5, wherein said step of determining said characteristics of said coating by analyzing said electrical characteristics of said electrical circuit comprises detecting a moment when said electrical characteristics change, wherein said change is an increase of said characteristics above a predetermined value for said object that comprises said combination of a conductive coating and a non-conductive substrate, and said change is a decrease of said characteristics below a predetermined value for said object that comprises said combination of a non-conductive coating and a conductive substrate.

16. The method of Claim 6, wherein said step of determining said characteristics of said coating by analyzing said electrical characteristics of said electrical circuit comprises detecting a moment when said electrical characteristics change, wherein said change is an increase of said characteristics above a predetermined value for said object that comprises said combination of a conductive coating and a non-conductive substrate, and said change is a decrease of said characteristics below a predetermined value for said object that comprises said combination of a non-conductive coating and a conductive substrate.

17. The method of Claim 7, wherein said step of determining said characteristics of said coating by analyzing said electrical characteristics of said electrical circuit comprises detecting a moment when said electrical characteristics change, wherein said change is an increase of said characteristics above a predetermined value for said object that comprises said combination of a conductive coating and a non-conductive substrate, and said change is a decrease of said characteristics below a predetermined value for said object that comprises said combination of a non-conductive coating and a conductive substrate.

18. The method of Claim 8, wherein said step of determining said characteristics of said coating by analyzing said electrical characteristics of said electrical circuit comprises detecting a moment when said electrical characteristics change, wherein said change is an increase of said characteristics above a predetermined value for said object that comprises said combination of a conductive coating and a non-conductive substrate, and said change is a decrease of said characteristics below a predetermined value for said object that comprises said combination of a non-conductive coating and a conductive substrate.

19. The method of Claim 9, wherein said step of determining said characteristics of said coating by analyzing said electrical characteristics of said electrical circuit comprises detecting a moment when said electrical characteristics change, wherein said change is an increase of said characteristics above a predetermined value for said object that comprises said combination of a conductive coating and a non-conductive substrate, and said change is a decrease of said characteristics below a predetermined value for said object that comprises said combination of a non-conductive coating and a conductive substrate.

20. The method of Claim 10, wherein said step of determining said characteristics of said coating by analyzing said electrical characteristics of said electrical circuit comprises detecting a moment when said electrical characteristics change, wherein said change is an increase of said characteristics above a predetermined value for said object that comprises said combination of a conductive coating and a non-conductive substrate, and said change is a decrease of said characteristics below a predetermined value for said object that comprises said combination of a non-conductive coating and a conductive substrate.

21. The method of Claim 1, wherein said analyzing said electrical characteristics of said electrical circuit comprises the steps of:

computing an integral of deviations of said electrical characteristics of said electrical circuit from a predetermined level of said electrical characteristics over a parameter selected from the group consisting of time, distance, force, and a number of cycles; and

comparing said integral with a predetermined value.

22. The method of Claim 7, wherein said analyzing said electrical characteristics of said electrical circuit comprises the steps of:

computing an integral of deviations of said electrical characteristics of said electrical circuit from a predetermined level of said electrical characteristics over a parameter selected from the group consisting of time, distance, force, and a number of cycles; and

comparing said integral with a predetermined value.

23. The method of Claim 8, wherein said analyzing said electrical characteristics of said electrical circuit comprises the steps of:

computing an integral of deviations of said electrical characteristics of said electrical circuit from a predetermined level of said electrical characteristics over a parameter selected from the group consisting of time, distance, force, and a number of cycles; and

comparing said integral with a predetermined value.

24. The method of Claim 9, wherein said analyzing said electrical characteristics of said electrical circuit comprises the steps of:

computing an integral of deviations of said electrical characteristics of said electrical circuit from a predetermined level of said electrical characteristics over a parameter selected from the group consisting of time, distance, force, and a number of cycles; and

comparing said integral with a predetermined value.

25. The method of Claim 10, wherein said analyzing said electrical characteristics of said electrical circuit comprises the steps of:

computing an integral of deviations of said electrical characteristics of said electrical circuit from a predetermined level of said electrical characteristics over a parameter selected from the group consisting of time, distance, force, and a number of cycles; and

comparing said integral with a predetermined value.

26. The method of Claim 11, wherein said analyzing said electrical characteristics of said electrical circuit comprises the steps of:

computing an integral of deviations of said electrical characteristics of said electrical circuit from a predetermined level of said electrical characteristics over a parameter selected from the group consisting of time, distance, force, and a number of cycles; and

comparing said integral with a predetermined value.

27. The method of Claim 12, wherein said analyzing said electrical characteristics of said electrical circuit comprises the steps of:

computing an integral of deviations of said electrical characteristics of said electrical circuit from a predetermined level of said electrical characteristics over a parameter selected from the group consisting of time, distance, force, and a number of cycles; and

comparing said integral with a predetermined value.

28. The method of Claim 13, wherein said analyzing said electrical characteristics of said electrical circuit comprises the steps of:

computing an integral of deviations of said electrical characteristics of said electrical circuit from a predetermined level of said electrical characteristics over a parameter selected from the group consisting of time, distance, force, and a number of cycles; and

comparing said integral with a predetermined value.

29. The method of Claim 14, wherein said analyzing said electrical characteristics of said electrical circuit comprises the steps of:

computing an integral of deviations of said electrical characteristics of said electrical circuit from a predetermined level of said electrical characteristics over a parameter selected from the group consisting of time, distance, force, and a number of cycles; and

comparing said integral with a predetermined value.

30. An apparatus for determining characteristics of a coating on a substrate that form an object, said apparatus comprising:

means for supporting said object,

an indenter for interacting with said object,

a loading unit for applying a force between said object and said indenter,

means for providing a relative movement between said object and said indenter,

means for forming an electrical circuit comprising a source of electrical power, a first electrical contact, and a second electrical contact,

means for measuring electrical characteristics of said electrical circuit, and

means for selectively connecting said first contact to said coating when said object comprises a conductive coating and a non-conductive substrate and to said substrate when said object comprises a non-conductive coating and a conductive substrate, and for selectively connecting said second contact to said conductive coating when said object comprises said conductive coating and said non-conductive substrate and to said indenter when said object comprises said non-conductive coating and said conductive substrate; at least a part of said indenter that interacts with said non-conductive coating being conductive if said indenter is selected.

31. The apparatus of Claim 30, wherein said means for providing a relative movement is selected from the group consisting of a linear unidirectional motion means, linear reciprocating motion means, rotary unidirectional motion means, and rotary reciprocating motion means.

32. The method of Claim 31, wherein said means for providing a relative movement consists of two motion means selected from the group consisting of a linear unidirectional motion means, linear reciprocating motion means, rotary unidirectional motion means, and rotary reciprocating motion means.

33. The apparatus of Claim 30, wherein said first contact and said second contact are a pair of interlocked contacts arranged so that said second contact is open when said first contact is closed, and said second contact is closed when said first contact is open.

34. The apparatus of Claim 31, wherein said first contact and said second contact are a pair of interlocked contacts arranged so that said second contact is open when said first contact is closed, and said second contact is closed when said first contact is open.